

Claims

1. (Withdrawn) A power converter comprising

a power module having

a power controlling semiconductor element disposed on the conductive member with an insulation member interposed and

a current detector for detecting current which is inputted into said power controlling semiconductor element or outputted from said power controlling semiconductor element; and a control unit for controlling operation of said power controlling semiconductor element, wherein

said current detector has

a conductor which is electrically connected to said power controlling semiconductor element, is disposed on said conductive member with an insulation member interposed, and has a portion relative distance of which to said conductive member is larger than relative distance between the laminated portion laminated on said conductive member with said insulation member interposed and the conductive member; and

a magnetic detecting unit which is disposed in said conductor portion or in the vicinity of said conductor portion relative distance of which to said conductive member is larger than relative distance between said conductor portion laminated on the conductive member with the insulation member interposed and said conductive member, and has a magnetic detecting semiconductor element which is electrically connected to said control unit.

2. (Withdrawn) A power converter according to claim 1, wherein relative distance between said conductor portion equipped with said magnetic detecting unit or disposed in the vicinity of said magnetic detecting unit and said conductive member is larger than relative distance between said power controlling semiconductor element and said conductive member.

3. (Withdrawn) A power converter according to claim 1, wherein said conductor portion relative distance of which to said conductive member is larger than relative distance between said conductor portion laminated on said conductive member with the insulation member interposed and said conductive member protrudes in the direction further away from said conductive member than said conductor portion laminated on said conductive member with said insulation member interposed.

4. (Withdrawn) A power converter according to claim 1, wherein a portion of said conductive member that corresponds to said conductor portion relative distance of which to said conductive member is larger than relative distance between said conductor portion laminated on the conductive member with the insulation member interposed and said conductive member is thinner than the other portion.

5. (Withdrawn) A power converter according to claim 1, wherein
said magnetic detecting unit is disposed in said conductor portion or in the
vicinity of said conductor portion relative distance of which to said conductive
member is larger than relative distance between said conductor portion
laminated on said conductive member with the insulation member interposed
and said conductive member so that said magnetic detecting unit detects
magnetic flux having a component parallel to said conductive member or to
induction current flowing through said conductive member among magnetic flux
generated by said conductor portion relative distance of which to said conductive
member is larger than relative distance between said conductor portion
laminated on said conductive member with the insulation member interposed
and said conductive member.

6. (Withdrawn) A power converter according to claim 1, wherein
said magnetic detecting unit is disposed in said conductor portion or in the
vicinity of said conductor portion relative distance of which to said conductive
member is larger than relative distance between said conductor portion
laminated on said conductive member with the insulation member interposed
and said conductive member so that said magnetic detecting unit detects
magnetic flux having a component parallel to the perpendicular line which
vertically intersects with said conductive member among magnetic flux
generated by said conductor portion relative distance of which to said conductive

member is larger than relative distance between said conductor portion laminated on said conductive member with the insulation member interposed and said conductive member.

7. (Withdrawn) A power converter according to claim 1, wherein said conductor portion relative distance of which to said conductive member is larger than relative distance between said conductor portion laminated on said conductive member with the insulation member interposed and said conductive member has a portion which is vertical to said conductive member and extends in the direction away from said conductive member, and

said magnetic detecting unit is disposed in said conductor portion which is vertical to said conductive member and extends in the direction away from said conductive member so that the surface of the magnetic detection surface of the said magnetic detecting semiconductor element is vertical to said conductive member and said conductor portion which extends in the direction away from said conductive member and parallel to said conductor portion which extends in the direction away from said conductive member.

8. (Withdrawn) A power converter according to claim 1, wherein said conductor portion relative distance of which to said conductive member is larger than relative distance between said conductor portion laminated on said conductive member with the insulation member interposed and said conductive

member has a portion which extends parallel to said conductive member, and
said magnetic detecting unit is disposed in said conductor portion which
extends parallel to said conductive member so that the magnetic detection
surface of said magnetic detecting semiconductor element is vertical and parallel
to said conductor portion which extends parallel to said conductive member.

9. (Withdrawn) A power converter comprising
a power module having
a power controlling semiconductor element electrically connected to a load
or an electric power supply means via a conductor,
a control unit for controlling operation of said power controlling
semiconductor element, and
a current detector disposed in said conductor, wherein
said current detector has a magnetic detecting unit which is configured
such that a magnetic detecting semiconductor element and a part of a connecting
conductor which electrically connects said magnetic detecting semiconductor
element with said control unit are encased in resin, and
at least a part of said magnetic detecting unit is contained in a depression
created in said conductor.

10. (Withdrawn) A power converter according to claim 9, wherein
said conductor is an out-going electrode of said terminal block in which the

wire electrically connected to said load or said electric power supply means electrically connects an electrode of a terminal block which is electrically connected by tightening a screw with said power module or said control unit, and said depression is provided in said out-going electrode.

11. (Withdrawn) A power converter comprising
a power module having
a power controlling semiconductor element, and
a current detector for detecting current which is inputted into said power controlling semiconductor element or outputted from said power controlling semiconductor element;

a control unit for controlling operation of said power controlling semiconductor element; and

a conductive member through which induction current flows due to electromagnetic induction generated by current flowing through said current detector, wherein

said current detector has

a conductor electrically connected to said power controlling semiconductor element, and

a magnetic detecting unit which is disposed in said conductor or in the vicinity of said conductor and has a magnetic detecting semiconductor element which is electrically connected to said control unit; and

among magnetic flux generated by said conductor,
said magnetic detecting unit detecting magnetic flux having a component parallel to said conductive member or to said induction current flowing through said conductive member.

12. (Withdrawn) A power converter according to claim 11, wherein
said conductor has a portion extends in the direction away from said conductive member, and
among magnetic flux generated by said conductor portion which extends in the direction away from said conductive member,
said magnetic detecting unit detects magnetic flux having a component parallel to said conductive member or to said induction current flowing through said conductive member.

13. (Withdrawn) A power converter according to claim 11, wherein
said conductor has a portion which is vertical to said conductive member and extends in the direction away from said conductive member, and
said magnetic detecting unit is disposed in said conductor portion which is vertical to said conductive member and extends in the direction away from said conductive member so that the magnetic detection surface of said magnetic detecting semiconductor element is vertical to said conductive member and said conductor portion extends in the direction away from said conductive member

and parallel to said conductor portion which extends in the direction away from said conductive member.

14. (Withdrawn) A power converter according to claim 11, wherein
said conductor extends parallel to said conductive member and has at least first and second bend, and
among magnetic flux generated said conductor portion located between said first bend and said second bend,
said magnetic detecting unit detects magnetic flux having a component parallel to said conductive member or to induction current flowing through said conductive member.

15. (Withdrawn) A power converter according to claim 11, wherein
said conductor extends parallel to said conductive member and
has at least first and second bend; and
said magnetic detecting unit is disposed in said conductor portion located between said first bend and said second bend so that the magnetic detection surface of said magnetic detecting semiconductor element is vertical to said conductor portion located between said first bend and said second bend and said conductive member and parallel to said conductor portion located between said first bend and said second bend.

16. (Withdrawn) A power converter comprising

a power module having

a power controlling semiconductor element and

a current detector for detecting current inputted into said power controlling semiconductor element or outputted from said power controlling semiconductor element;

a control unit for controlling operation of said power controlling semiconductor element; and

a conductive member through which induction current flows due to electromagnetic induction generated by current flowing through said current detector, wherein

said current detector has

a conductor which is electrically connected to said power controlling semiconductor element, extends parallel to said conductive member, and has at least first and second bend; and

a magnetic detecting unit which is disposed in said conductor portion located between said first bend and said second bend or in the vicinity of said conductor portion and has a magnetic detecting semiconductor element which is electrically connected to said control unit; and among magnetic flux generated by said conductor portion located between said first bend and said second bend, said magnetic detecting unit detecting magnetic flux having a component parallel to said conductive member or to said induction current flowing through said

conductive member.

17. (Withdrawn) A power converter according to claim 16, wherein
said conductor consists of a first conductor which is said conductor portion
located between said first bend and said second bend, a second conductor which
extends from said first conductor and bends at said first bend, and a third
conductor which extends from said first conductor and bends at said second
bend, and

among magnetic flux generated by said first conductor,
said magnetic detecting unit detects magnetic flux having a component
parallel to said conductive member or said induction current flowing through
said conductive member.

18. (Withdrawn) A power converter according to claim 16, wherein
said conductor consists of a first conductor which is said conductor portion
located between said first bend and said second bend, a second conductor which
extends from said first conductor and bends at said first bend, and a third
conductor which extends from said first conductor and bends at said second
bend, and

said magnetic detecting unit is disposed in said first conductor so that the
magnetic detection surface of said magnetic detecting semiconductor element is
vertical to said first conductor and said conductive member and parallel to said

first conductor.

19. (Withdrawn) A power converter comprising

a power module having

a power controlling semiconductor element, and

a current detector for detecting current inputted into said power controlling semiconductor element or outputted from said power controlling semiconductor element;

a control unit for controlling operation of said power controlling semiconductor element; and

a conductive member through which induction current flows due to electromagnetic induction generated by current flowing through said current detector, wherein

said current detector has

a conductor which is electrically connected to said power controlling semiconductor element and has at least first and second bend, and

a magnetic detecting unit which is disposed in said conductor portion located between said first bend and said second bend or in the vicinity of said conductor portion and has a magnetic detecting semiconductor element which is electrically connected to said control unit, and

among magnetic flux generated by said conductor portion located between said first bend and said second bend,

said magnetic detecting unit detecting magnetic flux having a component parallel to said conductive member or said induction current flowing through said conductive member.

20. (Withdrawn) A power converter according to claim 19, wherein said conductor is said conductor portion located between said first bend and said second bend and consists of a first conductor which extends vertical to said conductive member, a second conductor which extends from said first conductor and bends at said first bend, and a third conductor which extends from said first conductor and bends at said second bend, and

among magnetic flux generated by said first conductor, said magnetic detecting unit detects magnetic flux having a component parallel to said conductive member or said induction current flowing through said conductive member.

21. (Withdrawn) A power converter according to claim 20, wherein said second conductor and said third conductor have a right angle to said first conductor and extend in different directions.

22. (Withdrawn) A power converter according to claim 21, wherein said second conductor and said third conductor extend in the opposite directions.

23. (Withdrawn) A power converter according to claim 22, wherein said magnetic detecting unit is disposed on the plane such that the magnetic detection surface of said magnetic detecting semiconductor element is vertical to said second conductor and said third conductor using said first conductor's axis as an intersecting point so that among magnetic flux generated by said first conductor, said magnetic detecting semiconductor element detects magnetic flux having a component parallel to said conductive member or said induction current flowing through said conductive member.

24. (Withdrawn) A power converter according to claim 21, wherein said third conductor extends in the direction at an obtuse angle (i.e. θ is more than 90 degrees and less than 180 degrees) with said second conductor.

25. (Withdrawn) A power converter according to claim 24, wherein said magnetic detecting unit is disposed in the space in which the magnetic detection surface of said magnetic detecting semiconductor element is segmented by the plane vertical to said second conductor using the first bend as an intersecting point and in the space which is located on said third conductor side including said first conductor so that said magnetic detecting semiconductor element detects magnetic flux having a component parallel to said conductive member or said induction current flowing through said conductive member

among magnetic flux generated by said first conductor.

26. (Withdrawn) A power converter according to claim 24, wherein
said magnetic detecting unit is disposed in the space in which the magnetic
detection surface of said magnetic detecting semiconductor element is segmented
by the plane vertical to said second conductor using the first bend as an
intersecting point, and in the space which is located on said third conductor side
including said first conductor and is segmented by the plane vertical to said third
conductor using said second bend as an intersecting point, and also in the space
which overlaps with the space located on said second conductor side including
said first conductor so that said magnetic detecting semiconductor element
detects magnetic flux having a component parallel to said conductive member or
said induction current flowing through said conductive member among magnetic
flux generated by said first conductor.

27. (Currently amended) A power converter comprising
a power module having
a power controlling semiconductor element, and
a current detector for detecting current inputted into said power controlling
semiconductor element or outputted from said power controlling semiconductor
element;
a control unit for controlling operation of said power controlling

semiconductor element; and

a planar conductive member through which induction current flows at the surface due to electromagnetic induction generated by current flowing through said current detector, wherein

said current detector has

a conductor electrically connected to said power controlling semiconductor element, and

a magnetic detecting unit ~~which is disposed in said conductor or in the vicinity of said conductor and has a magnetic detecting semiconductor element which is electrically connected to said control unit, and~~

~~among magnetic flux generated by said conductor,~~

~~said magnetic detecting unit detecting magnetic flux having a component parallel to the perpendicular line which vertically intersects with said conductive member~~ for detecting a magnetic flux which is generated by the current flowing through said conductor, and

the magnetic detection surface of said magnetic detecting unit being parallel to the surface of said planar conductive member so that said magnetic detecting unit detects a component which is vertical to the surface of said planar conductive member, among magnetic flux generated by the current flowing through said conductor.

28. (Original) A power converter according to claim 27, wherein

said conductor has a portion which protrudes in the direction away from said conductive member, and among magnetic flux generated by said conductor portion protruding in the direction away from said conductive member; and

said magnetic detecting unit detects magnetic flux having a component parallel to the perpendicular line which vertically intersects with said conductive member.

29. (Original) A power converter according to claim 27, wherein

said conductor has a portion which protrudes in the direction away from said conductive member and is parallel to said conductive member; and

said magnetic detecting unit is disposed in said conductor portion which protrudes in the direction away from said conductive member and is parallel to said conductive member so that the magnetic detection surface of said magnetic detecting semiconductor element is parallel to said conductive member and is vertical and parallel to said conductor portion which protrudes in the direction away from said conductive member and is parallel to said conductive member.

30. (Withdrawn) An electric power system for converting electric power supplied by an electric power supply means into prescribed electric power by a power converter and supplying the power to a load, wherein a power converter according to claim 1 is used as said power converter.

31. (Withdrawn) An electric power system for converting electric power supplied by an electric power supply means into prescribed electric power by a power converter and supplying the power to a load, wherein a power converter according to claim 9 is used as said power converter.

32. (Withdrawn) An electric power system for converting electric power supplied by an electric power supply means into prescribed electric power by a power converter and supplying the power to a load, wherein a power converter according to claim 11 is used as said power converter.

33. (Withdrawn) An electric power system for converting electric power supplied by an electric power supply means into prescribed electric power by a power converter and supplying the power to a load, wherein a power converter according to claim 16 is used as said power converter.

34. (Withdrawn) An electric power system for converting electric power supplied by an electric power supply means into prescribed electric power by a power converter and supplying the power to a load, wherein a power converter according to claim 19 is used as said power converter.

35. (Withdrawn) An electric power system for converting electric power supplied by an electric power supply means into prescribed electric power by a

power converter and supplying the power to a load, wherein a power converter according to claim 27 is used as said power converter.

36. (Withdrawn) A mobile body comprising:

a body;

a driven device provided in said body;

a motor for being driven by an external power source or electric power supplied from an internal power source mounted to said body thereby driving said driven device; and

a power converter for controlling electric power supplied from said power source to said motor, wherein a power converter according to claim 1 is used as said power converter.

37. (Withdrawn) A mobile body comprising:

a body;

a driven device provided in said body;

a motor for being driven by an external power source or electric power supplied from an internal power source mounted to said body thereby driving said driven device; and

a power converter for controlling electric power supplied from said power source to said motor, wherein a power converter according to claim 9 is used as said power converter.

38. (Withdrawn) A mobile body comprising:

- a body;
- a driven device provided in said body;
- a motor for being driven by an external power source or electric power supplied from an internal power source mounted to said body thereby driving said driven device; and
- a power converter for controlling electric power supplied from said power source to said motor, wherein a power converter according to claim 11 is used as said power converter.

39. (Withdrawn) A mobile body comprising:

- a body;
- a driven device provided in said body;
- a motor for being driven by an external power source or electric power supplied from an internal power source mounted to said body thereby driving said driven device; and
- a power converter for controlling electric power supplied from said power source to said motor, wherein a power converter according to claim 16 is used as said power converter.

40. (Withdrawn) A mobile body comprising :

a body;

a driven device provided in said body;

a motor for being driven by an external power source or electric power supplied from an internal power source mounted to said body thereby driving said driven device; and

a power converter for controlling electric power supplied from said power source to said motor, wherein a power converter according to claim 19 is used as said power converter.

41. (Original) A mobile body comprising:

a body;

a driven device provided in said body;

a motor for being driven by an external power source or electric power supplied from an internal power source mounted to said body thereby driving said driven device; and

a power converter for controlling electric power supplied from said power source to said motor, wherein a power converter according to claim 27 is used as said power converter.

42. (New) The power converter according to claim 27, wherein said planar conductive member being a metal base plate on which said power controlling semiconductor elements are arranged with an insulation member interposed.